

REMARKS

Claims 1, 3, 8, 11 and 13 have been amended in order to more particularly point out, and distinctly claim the subject matter to which the applicant regards as his invention. The applicant respectfully submits that no new matter has been added.

At this time, the applicant and his undersigned representative thanks the Examiner for taking the time to conduct a personal interview with Examiner Neal Berezny on January 10, 2003 in the U.S. Patent and Trademark Office, and for the courtesy extended by Mr. Berezny to the undersigned during the interview.

In the noted interview, the undersigned reiterated the arguments previously presented (e.g., the second full paragraph, page 10 of the Amendment filed May 30, 2002) that Lu's PECVD has for an objective the N<sub>2</sub> reacting with WF<sub>6</sub> and H<sub>2</sub> for forming WN<sub>x</sub>, and with, additionally, SiH<sub>4</sub> for forming WsixNy. Absent the plasma, the N<sub>2</sub> does not react with other materials.

On the other hand, in the applicant's claimed invention, the claimed "reductive nitrogen-containing gas" is not reactive with other materials in CVD, but is a diluent gas in CVD for thermostability<sup>1</sup>. Thus, the applicant's claimed invention avoids a product, produced in the vapor-phase, that physically falls and lies on the substrate, deteriorates, and not suitable for uniform

---

<sup>1</sup>The Examiner was further referred to lines 16 and 17, page 20 of the applicant's specification.

depositing of a barrier film in a contact hole or groove having high aspect ratio.

After such discussions and having reviewed the amended claims filed on January 8, 2003, the Examiner, to which the applicant respectfully acknowledges with appreciation, informed the undersigned that the following outstanding: (a) objection to claim 8, (b) rejection of claims 3 and 13 under 35 USC 112, and (c) rejection of claims 1 - 5 and 8 under 35 USC 102(b) based on Lu will be withdrawn.<sup>2</sup>

However, the Examiner noted that, based on the amended claims filed on January 8, 2003, he still found the claims obvious under 35 USC 103(a) based on Lu.

In view of such a position, the undersigned then discussed the possibility of including the following language in the claims:

wherein said step of forming said film of the nitride includes a plasma-free formation of said film.

With such proposed claim amendments, the undersigned was informed that such additional amendments to the claims, in conjunction with the above-discussed arguments, would overcome the Lu reference. (Please see, the Examiner Interview Summary Record dated January 10, 2003.)

---

<sup>2</sup>It is also respectfully noted that the Examiner also pointed out that the phrase "temperature range" should be deleted as being indefinite. Accordingly, the applicant has deleted such term from the language of the claims.

Summarily,

- (1) the Examiner will withdraw the objection to claim 8, rejection of claims 3 and 13 under 35 USC 112, and rejection of claims 1 - 5 and 8 under 35 USC 102(b) based on Lu as a result of the claim amendments filed on January 8, 2003 (but such amendments will require an additional search for raising new issues);
- (2) the Examiner will withdraw the Lu reference (unless another prior art, for combining with Lu, is found in another prior art search) if the claims are further amended to include the above-discussed additional claim language (i.e., "wherein said step of forming . . . includes a plasma-free formation of said film"); and
- (3) the Examiner sees no problem in making claim 8 dependent on claim 1.

The above amendments to the claims are believed to place the claims in condition for allowance. Early and favorable action is awaited.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

In the event that any fees are due in connection with this paper, please charge our Deposit Account No. 01-2340.

Respectfully submitted,

ARMSTRONG, WESTERMAN & HATTORI, LLP



Mel R. Quintos  
Attorney for Applicant  
Reg. No. 31,898

MRQ/lrj/ipc

Atty. Docket No. **000155**  
Suite 1000, 1725 K Street, N.W.  
Washington, D.C. 20006  
(202) 659-2930



**23850**

PATENT TRADEMARK OFFICE

Enclosures: Version with markings to show changes made

IL HOME MBI TRANSFER 000155 PAM filed 1-17-03

IN THE CLAIMS:

Amend claims 1, 3, 8, 11 and 13 as follows:

1. (Thrice Amended) A process for producing a barrier film by a heat CVD method which comprises the steps of:

    providing a substrate on a substrate holder in a vacuum atmosphere within a CVD apparatus;  
    heating said substrate [at a temperature range];  
    introducing a feedstock gas having a high temperature-melting point metal in its structure, and a reductive nitrogen-containing gas comprising a nitrogen atom into said vacuum atmosphere; and

    forming a film of the nitride of said high temperature-melting point metal on said substrate, wherein said step of forming said film of the nitride includes a plasma-free formation of said film,

    wherin a nitrogen-free auxiliary reductive gas is introduced into said vacuum atmosphere.

3. (Thrice Amended) [The] A process for producing a barrier film by the heat CVD method, comprising the steps of:

    providing a substrate on a substrate holder in a vacuum atmosphere within a CVD apparatus;

heating said substrate [at a temperature range];  
introducing a feedstock gas having a high temperature-melting point metal in its structure  
into said vacuum atmosphere; and  
forming a film of the nitride of said high temperature-melting point metal on said  
substrate, wherein said step of forming said film of the nitride includes a plasma-free formation  
of said film,  
wherein a nitrogen-free auxiliary reductive gas is introduced into said vacuum  
atmosphere, said nitrogen-free auxiliary reductive gas being introduced together with said  
feedstock gas into said vacuum atmosphere.

8. (Thrice Amended) [A] The process for producing a barrier film by a heat CVD method  
according to claim 1, further comprising the steps of: [for] forming a barrier film made of a film  
of the nitride of a high temperature-melting point metal on a substrate on a substrate holder in a  
vacuum atmosphere within a CVD apparatus[, comprising the steps of]; exposing the surface of  
said substrate to a plasma of hydrogen gas and a plasma containing at least one gas selected from  
among argon, nitrogen and helium gases; and then forming the film of the nitride of said high  
temperature-melting point metal on the surface of the substrate, wherein the step of forming the  
film includes the [steps] step of heating the substrate [at a temperature range].

11. (Twice Amended) A process for producing a barrier film which comprises the steps  
of:

providing a substrate on a substrate holder in a vacuum atmosphere within a CVD

apparatus;

heating said substrate [at a temperature range];

introducing a feedstock gas having a high temperature-melting point metal in its structure, and a NH<sub>3</sub> gas into said vacuum atmosphere; and

forming a film of the nitride of said high temperature-melting point metal on said substrate, wherein said step of forming said film of the nitride includes a plasma-free formation of said film,

wherein a reductive Si-containing gas is introduced into said vacuum atmosphere.

13. (Twice Amended) The process for producing a barrier film, comprising the steps of: providing a substrate on a substrate holder in a vacuum atmosphere within a CVD apparatus;

heating said substrate [at a temperature range];

introducing a feedstock gas having a high temperature-melting point metal in its structure into said vacuum atmosphere; and

forming a film of the nitride of said high temperature-melting point metal on said substrate, wherein said step of forming said film of the nitride includes a plasma-free formation of said film,

wherein a reductive Si-containing gas is introduced into said vacuum atmosphere, said reductive Si-containing gas being introduced together with said feedstock gas into said vacuum atmosphere.